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## Health benefits of Jamun (*Syzygium cumini*) an Underutilised fruit: A ray in nanotechnology field

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### Abstract

Jamun is an important source of nutraceuticals having many therapeutic values. Jamun can be truly called as an important underutilised fruit crop in terms of area expansion as well as research. However these fruits act as miracle fruits in combating many of the health hazards. Apart from fruits other parts like leaves, bark, seed, flowers and roots are also rich source of several bioactive compounds like antioxidants, flavanoids, phenolics, carotenoids and vitamins. Thus these can be used efficiently against hypoglycaemic, antibacterial, anti-viral, anti-HIV, anti-cancer, anti-inflammatory properties. It can be also used as a potential source of medicine in both ayurveda and unani system. Now-a-days nanotechnology field has been emerged as a new area having a vast field related to drug delivery, bio imaging, medicine and pharmaceutical industries. Thus here an attempt has been made to collect various review literature regarding area of nanotechnology and health benefits of jamun fruits and other parts in combating various diseases.

**Keywords:** Jamun, nutraceuticals, medicinal value, diseases

### Introduction

*Syzygium cumini* (L.) (Myrtaceae) is a medicinal plant commonly known as Jamun in Hindi, Jambuda in Gujarati, Kala Jam in Bengali, Jambu in Marathi, Neredu in Telugu, Black plum or Indian Blackberry in English. It is among one of the least known fruit crops in India (Katiyar *et al.*, 2016) [26]. It is native of India but is now found in all tropical regions. It is a common fruit in summer and rainy seasons. Since time immemorial it has been valued in Ayurveda and Unani system. It possesses various therapeutic properties, while the seeds possess hypoglycemic, antibacterial, anti-HIV, anti-diarrhoeal properties (Choudhary *et al.*, 2012) [15]. It is very useful in the treatment of Diabetes mellitus, inflammation, ulcers and preclinical diseases. Fruits contain various types of antioxidants, flavonoids, phenolics, carotenoids and vitamins, which are all beneficial to human health. The seeds contain alkaloid, jambolin or antimellin, which halts the diastatic conversion of sugar to starch. The fruit pulp contains Vitamin A & C, nicotinic acid, riboflavin, folic acid, maleic acid, choline, sugar, amino acid, K, Ca, Na, P, Fe, Mn, Zn (Katiyar *et al.*, 2016) [26]. In spite of its high nutritional and medicinal values the commercial cultivation is lacking which needs to be popularised for commercial acceptance and orchard establishment in arid and semiarid regions of the country. Its fruit has a high potential source of nutritional and medicinal values. The value-added products of the crop need to catch national and international focus so that its nutritional and medicinal characteristics can be utilised in an ideal manner. The present study has been performed to access several bioactive compounds and health benefits of Jamun.

### Jamun as an underutilised fruit crop

Underutilised crops are those crops which are marginalised by farmers and consumers due to agronomic, genetic, economic, environmental and cultural reasons, which were once important and major crop in the community (IPGRI, 2000). In our country some of the major fruit trees like mango, banana, citrus, guava etc. are cultivated on a large scale still Jamun is cultivated on a minimal scale and still collected from forests. Despite many phytochemicals and pharmaceutical property in Jamun still, its cultivation is very limited and thus it needs more exploration.

### Botanical description and origin of Jamun tree

Jamun has been proved to be a boon to humankind since time immemorial. Jamun is an evergreen, very slow-growing tree and its expected lifecycle may extend up to a hundred or more number of years.

Its bark is light greyish and silver in colour and the plant is very much resistant to water stagnation condition. Leaves are simple, opposite, entire, elliptic to broadly oblong. Inflorescence of Jamun is borne in the axils of the leaves on the branchlets. Flowers are tiny, hermaphrodite and light yellowish-white in colour and borne without any stalks. Stamens are as long as calyx and the leaves have a pleasant aroma. Flowering starts from April-May. Fruits are oval to elliptical in shape and the colour varies from dark purple to black in colour. Fruit type is drupe i.e. it has superior ovary. Jamun has been originated from the Indian subcontinent and its adjoining South-east Asia. However, it is commercially cultivated in Java, Indonesia, Sri Lanka, Bangladesh etc.

### Taxonomical classification

Kingdom- Plantae

Order- Myrtales

Division- Angiosperm

Subdivision- Eudicots

Genus- *Syzygium*

Species- *cumini*

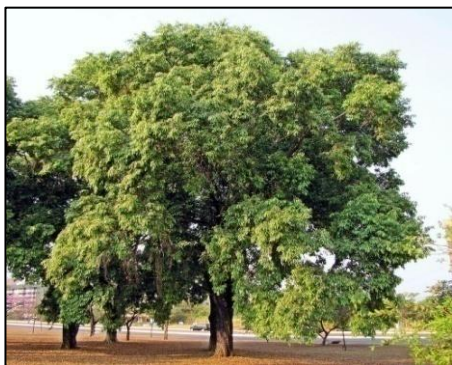


Fig 1: Jamun tree



Fig 2: Ripe Jamun fruits



Fig 3: Jamun flowers



Fig 4: Jamun bark



Fig 5: Jamun leaves

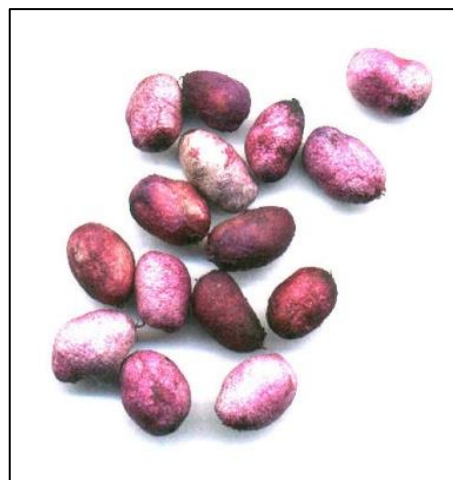


Fig 6: Jamun seeds

### The overall use of Jamun fruits including other parts (Traditional uses)

All the parts of Jamun trees including stems, flowers, seeds, fruits have some beneficial medicinal properties and it has already been described in various ancient medicinal recipes, which is considered as the backbone of Indian pharmaceutical industry. Even in Hindu religious epic Ramayana, the Jamun has got its importance because it is believed that Lord Rama survived for 14 years of his exilement by eating Jamuns. Hence it is also considered as "Food of God". The blackberries contain a very low amount of calories; thus, it is highly suitable for diabetic patients. The fruits are also rich in carbohydrate, vitamins, minerals like iron, magnesium, potassium, iron, fibre, carbohydrates and some other vitamins. Ayurveda and Unani always recommend consumption of these berries for treating various heart diseases, high sugar level, asthma, stomach pain and dysentery. Apart from these,

the fruits have unique antibacterial, antifungal, antiviral and antioxidant properties. Fruits are also a rich source of iron; thus, it ensures the supply of properly oxygenated blood throughout the body. The high vitamin C content in the fruits is found in Jamun. The fruits have a unique capacity to fight against malaria, cough, cold and bronchitis. It also helps in controlling Kapha and pitta. Jamun fruits are also used to cure piles (Joshi *et al.*, 2001) [24]. The ripe fruits are used for refreshing health drinks, making preserves, squashes, jellies and wine as reported by Warriar *et al.*, 1996 [57]. The seed powder helps in managing high sugar, high blood pressure, weight loss, reducing the quantity of sugar in urine and boosting immunity. In order to contract vagina after delivery, reduce mucous and bad smell, women of Surinam use Jamun leaves. (Ramya *et al.*, 2012) [39] Apart from these, the barks can be used for making various furniture. Jamun bark contains about 8-19% of tannin and it is very much useful for leather and preserving fishing net industry. The leaves can be used for strengthening gums and also for controlling constipation.

Jamun juice is often mixed with mango juice and it acts as a very good drink for quenching thirst in the diabetic patient. Many researchers have already confirmed about the presence of various phytochemicals and bioactive compounds present in Jamun and all other parts of the tree. Thus that has led to a significant change in the pharmaceutical industry.

#### Phytochemistry of Jamun- a miracle plant

Jamun fruits and all other parts are rich in various phytochemical compounds. Jamun fruits are rich in anthocyanin, glucosides, ellagic acid, isoquercetin, kaempferol, myricetin etc. Jamun seeds also contain a considerable amount of phytochemicals such as jambosine, gallic acid, ellagic acid, corilagin, quercetin,  $\beta$ -sitosterol etc. Flowers are rich in oleanolic acid. Astringency or sourness of fruit is due to gallic acid and tannins. Roots also contain several flavanoids and glycosides. Different plant parts are rich in different phytochemicals and those are enlisted below. (Table 1)

**Table 1:** Different phytochemicals present in different parts of Jamun plant

Plant parts	Phytochemical compounds present	References
Fruit pulp	Raffinose, Citric acid, Fructose, Gallic acid, Malic acid, Anthocyanin, Delphinidin, Petunidin, Malvidin	Srivastava <i>et al.</i> (1953) Lewis <i>et al.</i> (1956) [54, 29].
Seeds	Fats, Jambosine, Gallic acid, ellagic acid, Corilagin, other elements like Chromium, Vanadium, Potassium, Sodium, Zinc, tannins	Nadkarni <i>et al.</i> (1954) Chopra <i>et al.</i> (1956) Bhatia <i>et al.</i> (1975) [33, 17, 8].
Leaves	Bornyl acetate, Triantanol, n-Dotricontanol, Quercetin, Maslinic acid, Betulinic acid, Myricetin, n-nonacosane, n-dotricontanol	Craveiro <i>et al.</i> (1983) [16]
Flowers	Oleanolic acid, Ellagic acid, Isoquercetin, Kamferol, Myricetin, Camferol, Dihydro-myricetin, Quercetin, Arabinoside	Nair <i>et al.</i> (1974) Sagarwat <i>et al.</i> (2006) [34, 45].
Stem/bark	Friedelin, Ellagic acid, Gallic acid, Gallotannin, Ellagitannin, Myricetin, $\beta$ -sitosterol, Betulenilic acid	Bhargava <i>et al.</i> (1974) Nair <i>et al.</i> (1974) Yogeswari <i>et al.</i> (2005) [7, 34, 58].
Roots	Flavonoids, Glycosides and isorhamnetin 3-O-rutinoside	Vaishnavi <i>et al.</i> (1992) [56].

#### Bioactive compounds present in Jamun

Bioactive compounds are such chemical substances which are found in a very minute amount in various fruits, vegetables,

oilseeds, grains, pulses etc and these help in promoting a good healthy life. Several bioactive compounds are present in Jamun ex- terpenes, flavanoids, several liquids, alkane etc.

**Table 2:** Several bioactive compounds present in Jamun

Name of the bioactive compound	Compound present	Uses	References
Terpenes	1,8-cineol, Mysterol, Terpinolene, Linalool oxide, $\beta$ -terpenene, $\beta$ -pinema, Citronellol, Eugenol etc.	For pleasant flavour Food additives Pharmaceutical	Cho <i>et al.</i> (2017) [13]
Flavanoids	Isoquercetin, kaempferol, Malvidin, Myricetin, Petunidin, Quercetin, Anthocyanin, Cyanidin diglycoside	Antioxidant Colouring agent	Shashank <i>et al.</i> (2013) [53].
Lipids	Lauric acid, Linoleic acid, N-nanocosane, Stearic acid, N-hentriacontane, myristic acid, Lauric acid	Nematicide Antioxidant Anti-acne	
Alkanes	Malic acid, Citric acid	Antioxidant Antiseptic	
Phenols	Ferulic acid, Caffeic acid	Allelopathic Antibacterial	

#### Pharmacological Activities of Jamun Antioxidant

Shwag *et al.* (2016) [50] carried out an experiment to determine the composition and antioxidant potential of Jamun collected from eastern India and found that fruits from eastern India are rich sources of several minerals like potassium, sodium, magnesium, total dietary fibres and calcium. It was found that fruits had low to medium phenolics content and the kernel had low dietary fibre content than that of pulp. Several different types of solvents were extracted and it was found that 50% aq. Ethanol extract yielded maximum total phenolic content, which can be further isolated and utilised as antioxidants. Ruan *et al.* (2008) [44] studied the antioxidant

activity of Jamun leaf extracts by using DPPH and FRAPS assays. They confirmed that Jamun leaves contain phenolic compounds such as ferulic acid and catechin and these two are responsible for antioxidant property.

#### Antimicrobial

Elphadil *et al.* (2015) [19] in their experiment, found that Jamun leaves have significant antimicrobial activity against both gram-positive and gram-negative bacteria. The advantage of this experiment was these trees are locally available and these can be a cheap and sustainable way to irradiate any microbial contamination, particularly in developing countries. But here, further research work is to be

tone in order to determine the toxicity level and optimum dose of application for different fruit crops. Extraction and application of essential oil have been proved to control antibacterial properties against several *Bacillus sp.* (Shaffi *et al.*, 2002).

#### Anti-diabetic

Diabetes is becoming the third “killer” of the health of mankind along with cancer, cardiovascular and cerebrovascular diseases because of its high prevalence, morbidity and mortality (Li *et al.*, 2003). Gajera *et al.* (2017)<sup>[21]</sup> studied about the association ship of anti-diabetic and antioxidant substances with phenolic constituents from indigenous Jamun landraces and found that the fruit size was negatively correlated with phenols, anti-diabetic and antioxidant activities. It was also confirmed that seeds had more antioxidant and anti-diabetic property due to their kernel fraction.

Raza *et al.* (2017) conducted an experiment to study the effect of fruits and seed extracts of Jamun and found that this extract can reduce the level of blood glucose level in rats and it has also capacity to regulate insulin level. Shankar *et al.* (2007)<sup>[48]</sup> did an experiment to study the activity of two novel androgens (JB1 and JB2) derivatives isolated from ethanolic extracts of Jamun seeds and anti-diabetic effect of both was evaluated by using alloxan as diabetogenic agent. It was found that JB1 was more effective as compared to JB2. Sharma *et al.* (2003)<sup>[51]</sup> confirmed that alloxan initiated diabetes in bunnies can be cured effectively by an ethanolic concentrate of Jamun seeds.

#### Maintaining blood pressure

An experiment was carried out by Butt *et al.* (2017)<sup>[11]</sup> to evaluate both the efficiency of Jamun seeds and pulp against hyperglycemia in rats and it was found that both the seeds as well as the pulp had the capacity to regulate the blood sugar level significantly in the hypoglycaemic rats and the Jamun might have the capacity to regulate the insulin level.

#### Blood purifier

Jamun is rich in iron; hence it can truly act as a blood purifier so that there will be enough production of haemoglobin. Hence it acts as a protective food for menstruating women. (Katiyar *et al.*, 2007)

#### Anti-diarrhoeal property

Diarrhoea is often proved to be a fatal disease in both tropics and subtropics, causing around 5 million deaths annually throughout the world. Frequent passage of loose and watery stool from intestine is called as diarrhoea. In order to evaluate the anti-diarrhoeal property of aqueous Jamun seed in mice, Shankumar *et al.* (2012)<sup>[46]</sup> applied the method of castor oil-induced diarrhoea.

They found that aqueous Jamun seed extracts caused a significant and dose-dependent anti-diarrhoeal and anti-mortality effect. Mukharjee *et al.*, (1998)<sup>[32]</sup> tried ethanolic extracts four different indigenous plant types for anti-diarrhoeal property in rats and it was found that the extracts of pipal roots and Jamun bark had significant property against castor oil-induced diarrhoea in rats.

#### Hepatoprotective property

It is believed that Jamun has the unique capacity to destroy bad bacteria inside the stomach (Bhowmik *et al.*, 2013)<sup>[9]</sup>. Das *et al.* (2009)<sup>[18]</sup> concluded that ethanolic extract of Jamun

pulp @100 and 200 mg/kg/day induced with hepatotoxin paracetamol had significant hepatoprotective property in rats.

#### Anticancer property

Now a day's cancer is proved to be a killer disease. A majority portion of cancer-treating drugs are derived from natural resources. Very often, women are suffered from breast cancer. Aquil *et al.* (2016)<sup>[4]</sup> conducted an experiment to study the potential of Jamun against 17 $\beta$ -estrogen-mediated breast cancer and the study of m-RNA in inhibition of disease. Female rats were artificially fed with the diet enriched with Jamun supplement. After two weeks the rats received 17  $\beta$ -estradiol and were palpated weekly for mammary tumors. After 26 weeks, it was found that the Jamun enriched diet significantly delayed the first tumor appearance by 21 days. It also reduced the tumor incidence and tumor multiplication as compared to control.

Afify *et al.* (2011)<sup>[1]</sup> tried to estimate the anticancer activities of Jamun fruit extracts by using DPPH free radical scavenging assay and AMP cell line. They had used successive extracts of hexane, chloroform, ether, ethyl acetate, ethanol and water then the prepared solution was subjected for anticancer evaluation. It was found that the ethanolic extracts of Jamun fruits had excellent anticancer property.

#### Activity on the central nervous system

The effect of Jamun seeds on the central nervous system was studied by Kumar *et al.* (2007)<sup>[28]</sup>. The seeds were initially extracted with ethyl acetate and methanol investigation was done for its central nervous system activity of Albino mice by rota rod and actophotometer at 200mg/kg and 400mg/kg. Both the extract dose exhibited a significant amount of CNS activity.

#### Anti-inflammatory property

Kumar *et al.* (2010) confirmed that both ethyl acetate and methanol extracts of Jamun seeds worked significantly in carrageenan induced paw odema in rats at the oral dose level of 200 and 400 mg/kg. Thus both exhibited anti-inflammatory property. Jain *et al.* (2008)<sup>[23]</sup> evaluated the anti-inflammatory activity of ethyl acetate and methanol extracts of Jamun leave and found that when extracts were orally applied to paw oedema induced rats at 200 and 400 mg/kg both extracts had excellent anti-inflammatory property. Choudhary *et al.* (1990)<sup>[12]</sup> confirmed that the chloroform fraction of Jamun seeds had significant inhibition capacity against carrageenin, kaoline and other mediator induced oedema in rats. Apart from these, it was found the Jamun seeds had exudative, proliferative as well as antipyretic effect.

#### Antibacterial property

Anupam Kumar *et al.*, (2017) conducted an experiment to analyse various antioxidants and antibacterial property from extracts of Jamun seeds against pathogenic bacteria. The extracts were obtained by using several things like water, methanol and acetones.

They conducted various tests to evaluate the presence of alkaloids and flavanoids. Phytochemical extracts derived from seeds were examined for different gram-positive and negative bacteria. It was confirmed that extracts had several antioxidant properties which can be further utilised for treating various fatal diseases and it was also found that methanol derived extracts had more antibacterial property. Pareek *et al.*, (2015)<sup>[35]</sup> found that stem and leaf extracts had excellent

antibacterial property against all used bacteria and the maximum antibacterial effect was against *Rouletella plantikol*. Gowri *et al.*, (2010)<sup>[22]</sup> confirmed that methanol and aqueous extract of leaves exhibited antibacterial property against *Bacillus subtilis*, *Salmonella sp.*, *Pseudomonas aeruginosa*, *E. Coli*. Shafi *et al.*, (2010)<sup>[47]</sup> did a comparative study of the leaf oil of *Syzygium cumini* and *S. Travancoricum* and it was found that the leaf oil of Jamun leaves had an excellent antibacterial property whereas the other one showed a moderate effect.

#### Antiviral property

Bhanuprakash *et al.*, (2008) studied and confirmed that the leaves have antiviral property for goat pox virus. It was found that the hot and cold crude extracts of Jamun leaf and bark had antiviral property against avian influenza H5N1 virus. The inhibition was about 100% which was confirmed in virus yield reduction assay and by egg-based in ovo assay. (Sood *et al.*, 2012)<sup>[55]</sup>. Singh *et al.*, (1972) studied the effect of water extract of Jamun bark on potato X virus and it was found that the extract had antiviral property.

#### Antifungal property

Afshah *et al.* (2016) confirmed the antifungal property of Jamun bark and leaves against *Rhizoctonia solani*.

The leaves and barks from Jamun were ground properly and their extracts were prepared in methanol at a concentration of 1%, 2%, 3%, 4% and 5% and were tested against the targeted species. All the methanolic bark extract of Jamun were applied and it was found that concentration 5% was highly effective to suppress around 43% of the fungal growth as compared to treatment. Methanolic bark extracts were more powerful as compared to the leaf extracts.

Methanolic bark extracts were further subjected to fractionation and different fractions were isolated, then further serial dilution was carried out to check MIC with Pulsan fungicide. MIC was recorded for each fraction at 24,48 and 72 hours. N-butanol

and Puslan were highly effective in inhibiting the mycelium growth of *R. solani*.

#### Anti-fertility effect

Oleanolic acid had been extracted from Jamun flowers by Rajasekaran *et al.* (1988)<sup>[37]</sup> and it was clear that the certain chemical had the potential to decrease the fertilising capacity in male rats without any significant change in male reproductive organ weight.

#### Gastric ulcer effect

Ulcer is nothing but there will be any disruption on the mucosal integrity of the intestine or stomach that will lead to cause a defect in the evacuation purpose and there will be severe inflammation.

Chaturvedi *et al.* (2006) carried out an experiment to find out the effect of ethanolic extract of Jamun seeds for gastric secretion control in rats.

The result revealed that ethanolic extract of Jamun had some protective measures against ethanol and aspirin-induced gastric ulcer in rats. Jonnalagadda *et al.* (2013) found that seed kernels carried some antiulcer activity.

#### Anti-anemic property

Aqueous jamun seed extracts have the property to cure anemia as it increases the level of iron in the body. (Prince *et al.*, 1998)<sup>[36]</sup>.

#### Anti-pyretic effect

Mahapatra *et al.* (1986)<sup>[31]</sup> reported that the seed extracts of jamun (5,1 and 2mg/kg) had antipyretic property in rats against pyrexia in rats.

#### Radioprotective effect

Jagetia *et al.* (2002) confirmed the disease controlling effect of Jamun leaves against the radiation-induced DNA damage.

#### Anti-hyperlipidemic effect

Hyperlipidemia is a serious disease which is due to an increase in lipid peroxide levels and there will be a decrease in antioxidant level inside the body. Rekha *et al.* (2010)<sup>[43]</sup> found that the combined aqueous application of bark of cinnamon along with Jamun pulp has significantly better result against streptozotocin induced diabetic rats. Sharma *et al.* (2008)<sup>[52]</sup> demonstrated that the seed extracts of Jamun had excellent anti-hyper-lipidemic property in mice.

A study was conducted by Ravi *et al.* (2005)<sup>[41]</sup> in order to study the antihyperlipidemic property of Jamun seed kernel and the effect was evaluated in streptozotocin induced diabetic rats. The overall efficiency was compared with gibenclamide (a standard hypoglycaemic drug). The ethanolic extracts of Jamun seed kernel was orally administered to the rats and the level of phospholipid, cholesterol and free fatty acid etc were measured. It was found that the level of phospholipid, cholesterol and free fatty acid was significantly more and restored to near normal in seed kernel or gibenclamide treated animals.

#### Anti-allergic property

Brito *et al.* (2007)<sup>[6, 10]</sup> carried out HPLC analysis and it was found that hydrolysable flavanoids and tannins are the major ingredients in the aqueous leaf extracts of Jamun. It was also found that oral administration of 25-100 mg/kg of the solution in swiss mice inhibited the edema induced by histamine. They also confirmed that the anti-allergic property is only due to mass cell de-granulation and histamine effect. Methanolic extracts of dried Jamun seeds had antiallergic property. (Mahapatra *et al.*, 1986)<sup>[31]</sup>.

#### Anti eosinophill effect

Brito *et al.*, (2007)<sup>[6, 10]</sup> again confirmed that due to impairment of eotaxin and IL-5 production, there was an anti-eosinophill effect of leaf extracts on Jamun.

#### Anti-arthritis effect

Eshwarappa *et al.*, (2014)<sup>[20]</sup> conducted an experiment and found that Jamun leaf gall extracts has some antioxidant property and that can be used for curing for arthritis.

#### Hypolipidemic property

Kasiappan *et al.*, (2005)<sup>[25]</sup> conducted an experiment to study the hypolipidemic property of Jamun in diabetic rats. They found that the ethanolic extracts of Jamun seed kernels had the potential to store all parameters like triglycerides, cholesterol, phospholipids etc to a normal level.

#### Free radical scavenging and anti-lipid peri-oxidative property

Benherlal *et al.*, (2007)<sup>[5]</sup> carried out an experiment to study the *in-vitro* antioxidant and chemical composition of Jamun fruits. Mainly the experiment was to study the medicinal property fruit pulp, seed coat, kernel and seed coat. Fruit pulp and their ethanolic extracts of Jamun were evaluated for

chemical composition and for lipid peroxidative inhibition activity. It was seen that seed and pulp extracts had lower anti-lipid peroxidative property than the kernel.

#### Antiulcer property

Ulcer is a detrimental disease and it was found that the seeds of Jamun had ulcer curing capability in diabetic rats. (Chaturvedi *et al.*, 2007)<sup>[14]</sup>

#### Anti-dermatophytic property

It was found that the EtOA extracts of the bark of Jamun had antidermatophytic property against three dermatophytic species. Among several triterpenes such as friedelin,  $\beta$ -amyryn acetate, betulinic acid and lupeol betulinic acid and friedelin was more effective. (Kuiate *et al.*, 2007)<sup>[27]</sup>.

#### Impact on Nanotechnology

In the present scenario, nanotechnology ruling awareness to discover a range of promising approaches in the area of material sciences on a molecular level and silver nanoparticles (AgNPs) productions. The seed extract of *Syzygium cumini* used as reducing agent for nanoparticle production. The leaf extract also used as capping and reducing agent in the synthesis of silver nano particles (Ram Prasad *et al.*, 2012)<sup>[38]</sup>. UV-Vis spectrophotometer, Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM) technology are mostly used for confirmation of nanoparticles formation. Further antimicrobial activity of silver nanoparticles was studied against *Escherichia coli* MTCC 1302, *Staphylococcus aureus* MTCC 740, *Pseudomonas aeruginosa* MTCC 2295, and *Bacillus licheniformis* MTCC 9555 (Ram Prasad *et al.*, 2012)<sup>[38]</sup>. As compared to the others, conventional approaches for the green production of metal nanoparticles of Jamun helps in the simple, sustainable, non-toxic, economic and energy-effective production of nanoparticles. In adding up to this synthesised metal NPs might be a promising aflatoxins adsorbent for the detoxification of aflatoxin B1 in human and animal food/feed. Recently one research suggests that iron (Fe), copper (Cu) and silver (Ag) nanoparticles (NPs) formation from the extract of *Syzygium cumini* leaves (Asghar *et al.*, 2020)<sup>[3]</sup>.

#### Conclusion

Jamun is a rich source of several important phytochemicals and other biochemical compounds. Still, Jamun remained as an under-exploitable crop or underutilised crop. Hence people should be aware of the health benefits that Jamun possesses so that we can go towards a healthy society.

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